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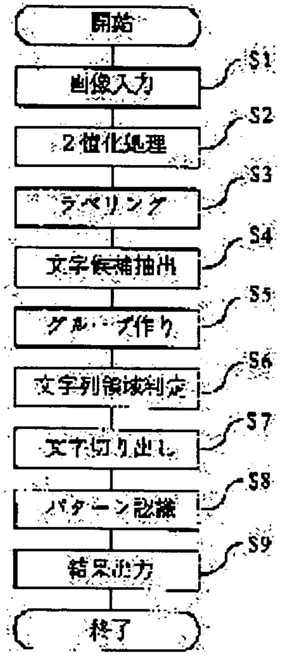
(54) CHARACTER AREA DETERMINING METHOD FOR IMAGE

(57)Abstract:
PURPOSE: To provide a character area determining method for an image which can accurately determine a character area even when image data include a background image other than a character string and the character quality is inferior.
CONSTITUTION: The image including the character string which has specific arrangement and consists of characters of the same size is inputted and binarized (S1 and S2), character candidates whose features meet specific conditions are extracted from all connected pixels included in the processed data (S3 and S4), and the circumscribed rectangular area including all character candidates whose mutual position relation shows the specific arrangement (S5 and S6). Consequently, the character area can accurately be determined at all times.



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CLAIMS

[Claim(s)]
[Claim 1] The alphabetic character field decision approach of an image of determining a circumscription rectangle field including all the alphabetic character candidates for whom the alphabetic character candidate with whom the description is satisfied of predetermined conditions extracts, and the above-mentioned alphabetic character candidates' physical relationship arranges predetermined [above-mentioned] as the alphabetic character field of the above-mentioned image out of all the connection pixels that input and binary--ization-process the image containing the character string which consists predetermined arrangement of an alphabetic character of the nothing and same magnitude, and are contained in the above-mentioned processed data.
[Claim 2] The alphabetic character field decision approach of an image according to claim 1 that an extract of the above-mentioned alphabetic character candidate is that at least one of the aspect ratio of the magnitude of the circumscription rectangle of a connection pixel and the circumscription rectangle of a connection pixel, the area of a connection pixel, the surface ratio of a connection pixel and its circumscription rectangle, and the ratios of the square and area of the boundary length of a connection pixel extracts what exists within limits set up beforehand out of the connection pixel of all above.
[Claim 3] The alphabetic character field decision approach of an image according to claim 1 that the above-mentioned predetermined arrangement consists of the width of character set up beforehand, height, and character spacing of length and a longitudinal direction.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the alphabetic character field decision approach of an image, and relates to the approach of determining an alphabetic character field in the case of image recognition, in detail.
[0002]
[Description of the Prior Art] Generally as a production-control means in works, performing stamp, marking, etc. to a member is performed. For example, in the production line of an iron mill, a character string is drawn on slab, a billet, etc. in many cases. Picturizing these character strings with a CCD camera etc., and making it recognize on a computer conventionally with FA-izing, CIM-izing, and the formation of ** people of the works in recent years, although human being had read these character strings came to be tried. In that case, the decision of the alphabetic character field of an image pick-up image extracts the character string which performs binary-ized processing with a suitable threshold, and targets image data from level projection data distribution first, and is performed by next searching for the vertical projection. And generally the approach logging of an alphabetic character performed the part into which this determined alphabetic character field has broken off noting that it is a clearance between an alphabetic character and an alphabetic character was used.
[0003]
[Problem(s) to be Solved by the Invention] Since they will also be contained in the projection by the alphabetic character field decision approach of the conventional image which was described above when patterns other than alphabetic characters, such as a background image and a noise, exist in the image data after binary-ized processing, if it remains as it is, it is difficult to determine an alphabetic character field correctly and to start an alphabetic character from there. For this reason, in such a case, the character string's of image existence range is fixed beforehand, a printing side is moved to it so that a character string may enter within the limits of it, and generally the method of taking the projection of only that range is used for it. However, in the case of an image input, location fluctuation of a printing side is large, and when a character string cannot be arranged at a position, such an approach cannot be used. Moreover, generally the front face (especially end face) of steel materials is not flat in many cases, and it is easy to produce blur fellow blurring of an alphabetic character in the case of printing or a stamp. Furthermore, it is difficult to set up a threshold suitable in the case of binary-ized processing from the condition of the screen of an alphabetic character, the temporal response of image pick-up conditions, etc. in many cases. An alphabetic character chip, connection of two or more characters, etc. arise, and the quality of an alphabetic character on image data will tend to become inferior from these reasons. Therefore, a way piece did not arise in the suitable location for the projection of a character string, but the alphabetic character might be started in the mistaken location. In order to solve the technical problem in such a Prior art, the alphabetic character field decision approach of an image is improved, background images other than a character string are contained in image data, and this invention aims at offering the alphabetic character field decision approach of an image that an alphabetic character field can be determined correctly, also when the quality of an alphabetic character is inferior.
[0004]
[Means for Solving the Problem] In order to attain the above-mentioned purpose, this invention inputs the image containing the character string which consists predetermined arrangement of an alphabetic character of the nothing and same magnitude. It binary--ization-processes. As the alphabetic character field decision approach of an image of determining a circumscription rectangle field including all the alphabetic character candidates for whom the alphabetic character candidate with whom the description is satisfied of predetermined conditions is extracted, and the above-mentioned alphabetic character candidates' physical relationship arranges predetermined [above-mentioned] out of all

the connection pixels contained in the above-mentioned processed data as the alphabetic character field of the above-mentioned image It is constituted. Furthermore, an extract of the above-mentioned alphabetic character candidate is the alphabetic character field decision approach of the image which is extracting what has at least one of the aspect ratio of the magnitude of the circumscription rectangle of a connection pixel, and the circumscription rectangle of a connection pixel, the area of a connection pixel, the surface ratio of a connection pixel and its circumscription rectangle, and the ratios of the square and area of the boundary length of a connection pixel within limits set up beforehand out of the connection pixel of all above. Furthermore, it is the alphabetic character field decision approach of an image that the above-mentioned predetermined arrangement consists of the width of character set up beforehand, height, and character spacing of length and a longitudinal direction.

[0005]

[Function] According to this invention, the image containing the character string which consists predetermined arrangement of an alphabetic character of the nothing and same magnitude is inputted and binary--ization-processed. The alphabetic character candidate with whom the description is satisfied of predetermined conditions is extracted out of all the connection pixels contained in the above-mentioned processed data. A circumscription rectangle field including all the alphabetic character candidates the above-mentioned alphabetic character candidates have a position relation is determined as the alphabetic character field of the above-mentioned image. Thus, patterns other than alphabetic characters, such as a background image which does not fill conditions and position relation predetermined [above-mentioned], are eliminated. Moreover, since the alphabetic character which went into an alphabetic character candidate neither by the alphabetic character chip nor connection of two or more characters is finally also contained to an alphabetic character field, even if it is the case where the alphabetic character with the inferior quality of an alphabetic character is contained in the character string, it can determine an alphabetic character field correctly.

[0006]

[Example] Below, with reference to an accompanying drawing, it explains per [which materialized this invention] example, and an understanding of this invention is presented. In addition, the following examples are examples which materialized this invention, and are not the things of the character which limits the technical range of this invention. The whole flow Fig. showing the outline configuration of the character recognition approach including the alphabetic character field decision approach of the image which drawing 1 requires for one example of this invention here, the mimetic diagram showing the whole equipment configuration to which drawing 2 can apply the above-mentioned character recognition approach, and drawing 3 an example of the input image after binary-ized processing The shown explanatory view, the partial flow Fig. in which drawing 4 shows the procedure of making a group, the explanatory view in which drawing 5 shows the physical relationship of a reader and other alphabetic character candidates, the explanatory view showing the reference value [as opposed to character string information in drawing 6] set up beforehand, and drawing 7 are the explanatory views showing an example of an alphabetic character field extract result when the quality of an alphabetic character is inferior. As shown in drawing 1 , the alphabetic character field decision approach of the image concerning this example The image containing the character string which accomplishes predetermined arrangement and consists of an alphabetic character of the same magnitude is inputted and binary--ization-processed (S1, S2). The alphabetic character candidate with whom the description is satisfied of predetermined conditions is extracted out of all the connection pixels contained in the above-mentioned processed data (S3, S4). a circumscription rectangle field including all the alphabetic character candidates for whom the above-mentioned alphabetic character candidates' physical relationship arranges predetermined [above-mentioned] is determined as the alphabetic character field of the above-mentioned image -- it is constituted like (S5, S6). moreover, (S9) which the character recognition approach including the alphabetic character field decision approach of this image starts an alphabetic character from the alphabetic character field of the above-mentioned image (S7), performs pattern recognition (S8), and outputs that result -- it is constituted like.

[0007] The above-mentioned character recognition approach is embodied by the character reader as shown in drawing 2 . That is, drawing 2 is an example of equipment which recognizes the marking alphabetic character of a billet edge. In this drawing, a billet 2 is conveyed according to the conveyance devices 1, such as a conveyor, in a camera station. The character string 4 is beforehand drawn on the end face 3 of a billet by predetermined arrangement by spray-type marking equipment (un-illustrating). All the graphic sizes currently drawn here shall be the same, and shall have accomplished the character string of two line x3 train (equivalent to predetermined arrangement). This character string 4 is photoed with the photography equipments 5, such as a CCD camera. The image containing the photoed character string 4 is inputted into an image processing system 6, processing of character recognition etc. is made here, and a recognition result is sent to a host computer 7. A series of flow of the character recognition by this equipment is further explained in full detail in order of steps S1 and S2 and -- using drawing 1 and drawing 2 . First, photography equipment

5 performs an image input to an image processing system 6 (S1). And binary-ized processing is performed for the obtained image data with a suitable threshold (S2). Drawing 3 is an example of the image data after performing binary-ized processing. In this example, it also assumed that a billet 2 shifted from an orientation to four directions and order in the case of photography, and the large camera visual field is taken. Therefore, in drawing 3 , background images, such as head-lining lighting, are contained besides character string 4.

[0008] Next, a connection pixel (henceforth a pattern) is extracted and labeling processing which numbers to each is performed (S3). And the thing applicable to the criteria (equivalent to predetermined conditions) of the alphabetic character beforehand set up among each pattern is extracted, and it considers as an alphabetic character candidate (S4). In this example, the magnitude and the aspect ratio of a circumscription rectangle of a pattern make what is contained in the predetermined range the alphabetic character candidate. The pattern judged not to be an alphabetic character clearly from magnitude, an aspect ratio, etc. in this phase is deleted. In addition, it can have the surface ratio of the area of a pattern, and a pattern and its circumscription rectangle besides the magnitude and the aspect ratio of a circumscription rectangle of a pattern, can have the ratio of the square of the boundary length of a pattern, and area in a list, and can also consider as the decision criterion of an extract of an alphabetic character candidate. Next, it performs making the group which uses each alphabetic character candidate as a reader (S5). A group means a set of the alphabetic character candidate by whom physical relationship with a reader was judged to have agreed to the information on the character string set up beforehand (henceforth character string information) here. Hereafter, with reference to drawing 4 , it explains this making a group in full detail in order of steps S51 and S52 and --.

[0009] First, one alphabetic character candidate is chosen in an order from an alphabetic character candidate's inside, and let it be a group's reader (S51). Next, one alphabetic character candidate is chosen in an order from the inside of alphabetic character candidates other than a reader (S52). Alphabetic character candidates other than this reader judge whether it is contained in the same group as a reader (S53). Specifically, this judgment is performed by including the alphabetic character candidate who fills (following 1) and following (2) types in the same group.

$m-dm<dW/(W+W^{*} (dFW/FW)) <m+dm$ (m=-2, -1, 0, 1, 2) -- (1)

$n-dn<dH/(H+H^{*} (dFH/FH)) <n+dn$ (0 n=-1, 1) -- (2)

Here, as shown in drawing 5 and drawing 6 , Variables W and H are the width of face of a reader's 61 circumscription rectangle, and height, respectively, Variables dW and dH are the length of the coordinate at the upper left of each circumscription rectangle of a reader 61 and the alphabetic character candidate 62, and lateral spacing, respectively, and these variables make the above-mentioned character string information. Moreover, each variables FW, FH, dFW, and dFH are the values beforehand defined based on character string information, and are the reference values of length with the marking width of character, height, and an adjoining marking alphabetic character, and a lateral distance, respectively. Furthermore, m and n are values which show the physical relationship of a reader 61 and the alphabetic character candidate 62 in every direction, and m takes the integral value between -2-+2 and n-1-+1 here. Moreover, dm and dn are the margins (<0.5) of m and n, respectively.

[0010] That is, the alphabetic character candidate in one right and left of a reader or two, and the location shifted one upper and lower sides will be included in a group. Thereby, since a character pattern, magnitude, and an aspect ratio are alike, the background pattern which serves as an alphabetic character candidate is excepted in this phase, and only the pattern corresponding to character string information is contained in a group. And if all alphabetic character candidates other than a reader finish judging whether it is contained in a group, it will progress to the following step (S54). If there is a candidate whom the judgment has not finished, it will return to the above-mentioned step S52. Next, a score is attached to a group (S55). He is trying to turn into a high score, so that a score has many alphabetic character candidates contained in the group and its distance of each alphabetic character candidate's coordinate and the main coordinate of the alphabetic character field obtained experientially is still nearer. And if all alphabetic character candidates become a reader, it will end (S56). If there is an alphabetic character candidate who is not a reader, it will return to the above-mentioned step S51. Thus, after performing making a group, a group with the highest score is chosen in each group, and an alphabetic character candidate's maximum circumscription rectangle contained in the group is determined as an alphabetic character field (S6). an alphabetic character chip as this shows to drawing 7 (a) -- or the alphabetic character which was not extracted as an alphabetic character candidate in the above-mentioned step S4, such as connection of an alphabetic character as shown in drawing 7 (b), will also be contained to an alphabetic character field. That is, in this example, even if the low quality alphabetic character is contained in the character string, it becomes possible to determine an alphabetic character field correctly.

[0011] Next, in accordance with character string information, an alphabetic character field is divided into two line x3 train six, is started in it, and let each be an alphabetic character (S7). And pattern recognition is performed to each alphabetic character (S8), and the recognition result is outputted to a host computer 7 (S9). As mentioned above, according to this example, even if many patterns other than an alphabetic character are contained and it is from image data whose location of a character string is unfixed, it is possible to extract an alphabetic character field. Therefore, since it is not necessary to arrange a character string in the predetermined range in the case of an image input, the character string written to the printing side in which exact positioning is impossible can also be extracted. Moreover, it is not necessary to put the excessive mark for extracting an alphabetic character field from the inside of an image. Furthermore, even if it is the case where the low quality alphabetic character for which exact logging was difficult is contained in the character string by the approach using the conventional projection, in this example, an alphabetic character field can be extracted correctly. Therefore, the rest becomes possible [starting an alphabetic character correctly] by combining with character string information and dividing an alphabetic character field. Since the accuracy of alphabetic character logging is directly linked with the accuracy of character recognition, it can raise the rate of a correct answer of character recognition sharply by this example.

[0012]

[Effect of the Invention] Since the alphabetic character field decision approach of the image concerning this invention is constituted as described above, background images other than a character string are contained in image data, and also when the quality of an alphabetic character is inferior, it can determine an alphabetic character field correctly.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The whole flow Fig. showing the outline configuration of the character recognition approach including the alphabetic character field decision approach of the image concerning one example of this invention.
[Drawing 2] The mimetic diagram showing the whole equipment configuration which can apply the above-mentioned character recognition approach.
[Drawing 3] The explanatory view showing an example of the input image after binary-ized processing.
[Drawing 4] The partial flow Fig. showing the procedure of making a group.
[Drawing 5] The explanatory view showing the physical relationship of a reader and other alphabetic character candidates.
[Drawing 6] The explanatory view showing the reference value over character string information set up beforehand.
[Drawing 7] The explanatory view showing an example of an alphabetic character field extract result when the quality of an alphabetic character is inferior.
[Description of Notations]
S1 -- Image input process
S2 -- Binary-ized down stream processing
S3 -- Labeling process
S4 -- Alphabetic character candidate extract process
S5 -- Group making-process
S6 -- String area judging process

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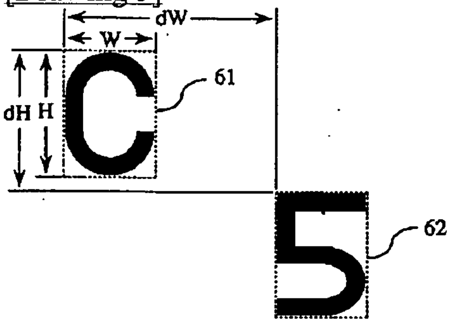
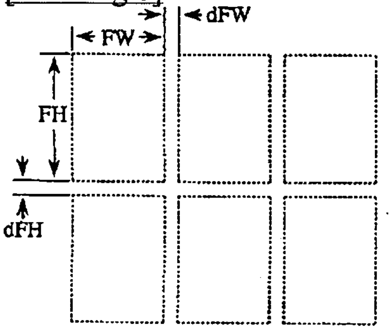
DRAWINGS

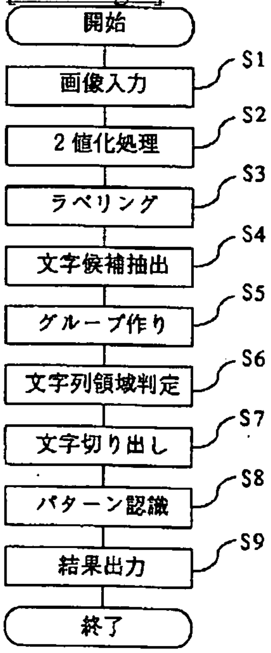
[Drawing 5]


dW
W
dH
H
61
62

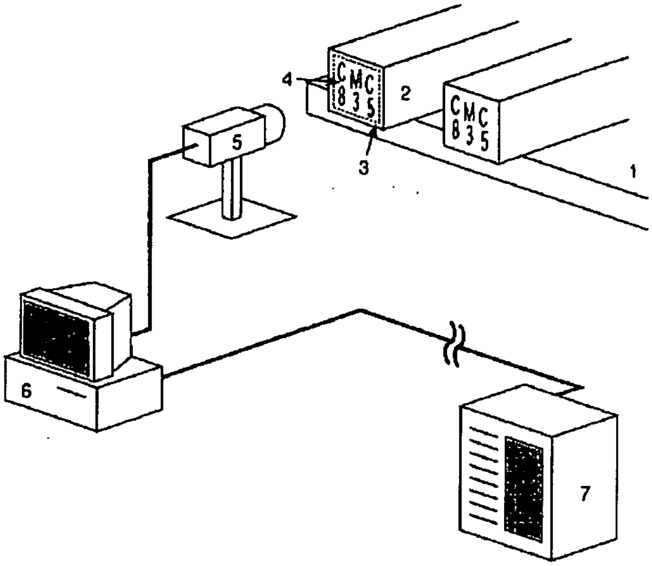
[Drawing 6]


FW
dFW
FH
dFH

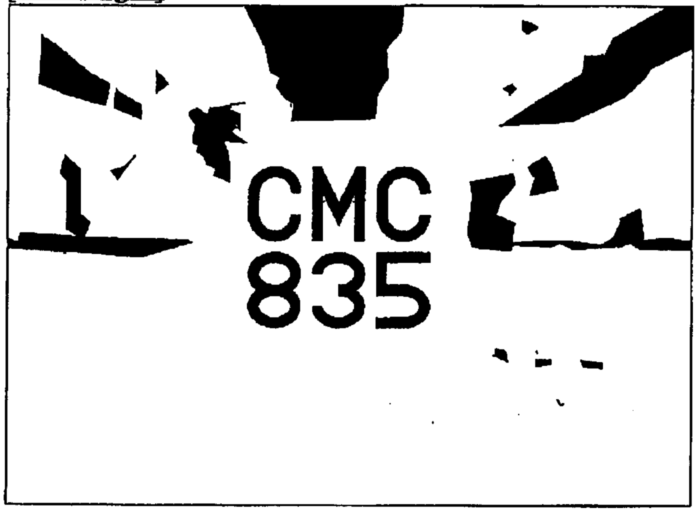
[Drawing 1]


開始
画像入力
S1
2値化処理
S2
ラベリング
S3
文字候補抽出
S4
グループ作り
S5
文字列領域判定
S6
文字切り出し
S7
パターン認識
S8
結果出力
S9
終了

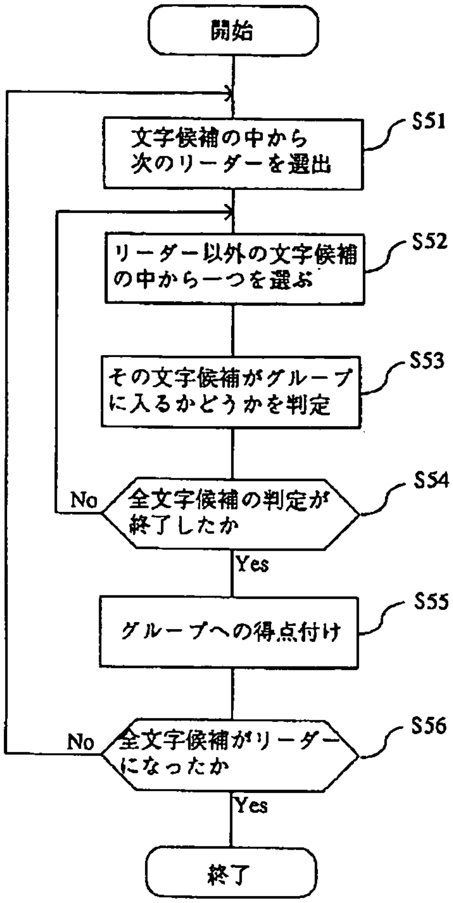
[Drawing 2]


4
CMC
835
2
3
1
5
6
7

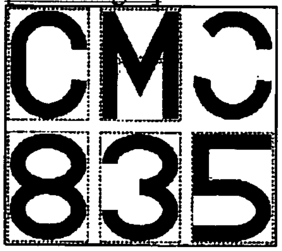
[Drawing 3]



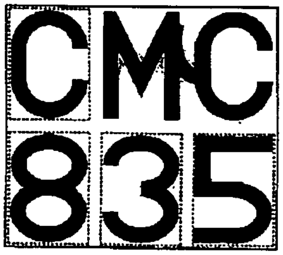
[Drawing 4]


開始
文字候補の中から次のリーダーを選出
S51
リーダー以外の文字候補の中から一つを選ぶ
S52
その文字候補がグループに入るかどうかを判定
S53
全文字候補の判定が終了したか
S54
No
Yes
グループへの得点付け
S55
全文字候補がリーダーになったか
S56
No
Yes
終了

[Drawing 7]



（ａ）文字欠けの例



（ｂ）文字連結の例

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